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Flow properties of sandstone and carbonate rocks by X-ray computed tomography

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Abstract

We report the use of X-ray micro-CT and numerical simulations for studying the reservoir properties of sandstone and carbonate rocks in the Melekess depression of the Volga-Ural anteclise, Russia. To simulate the flow of a viscous fluid in the pore scale, we use a mathematical model which consists of the continuity equation, stationary Navier-Stokes equations and Darcy law. As a result of computational micro-scale experiments on digital three-dimensional images of sandstone, we get satisfactory compatible permeability coefficients, which are calculated using Navier-Stokes and Kozeny-Carman equations. Carbonates with fracture porosity reveals significant variations in permeability coefficients, calculated by the two methods. The Kozeny-Carman equation can describe the flow properties of carbonates with a predominantly matrix porosity. It is shown that a pronounced heterogeneity of the pore space leads to the representative elementary volume for permeability coefficient in carbonates several times larger than in sandstones.

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Keywords

Carbonate, Flow properties, Permeability, Sandstone, X-ray computed tomography